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Factors Affecting

Kid Production of Angora Does

THE AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
TEXAS AGRICULTURAL EXPERIMENT STATION

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Summary

An increase in fertility or kid production represents one of the important means of improving the productive efficiency of Angora goats. The number of kids raised is important because of the direct monetary value and because it affects the amount of culling that can be done for quantity and quality of mohair. Since the most efficient production and the best quality mohair is obtained from younger animals, 5 years or less, it is important that the average age of the doe flock be kept as low as possible. This can be accomplished only by having a high reproductive rate at an early age. Considerable opportunity exists for improvement in this area.

A study was made of the records collected over a long period on the experimental flock maintained at Substation No. 14, Sonora, Texas, to attempt to isolate some of the factors affecting kid production.

The percentage of kids dropped and raised increased with advancing age up to 7 years; after this it decreased. Kid production was low during the first years, especially at 2 years (48.5 percent). The major opportunity to improve kid production is among the young does, thus benefiting the flock by lowering their average age. Face covering and size or development had a major effect on kid production of the younger does. Does with mohair covering on the face generally failed to kid until they were 3 or 4 years old. Differences in the number of kids dropped were as great as 62 percent when 2-year-old open and covered-face does were compared. These differences were approximately 25 percent when values for life time production were used. These values would have been 35 percent had all of the does been culled at 5 years.

Lack of development (size) is the major factor affecting fertility. Face covering affects fertility mostly through its influence on size and development. Angora does generally do not breed until an adequate state of physiological development is reached. This phenomenon seems to be more pronounced with Angora does than with other livestock species. For best breeding performance, yearling Angora does should weigh a minimum of 55 pounds (shorn body weight) when they enter the breeding flock. Mature Angora does should weigh a minimum of 75 pounds (shorn body weight) at the beginning of the breeding season.

Inheritance, stocking rate, rainfall and, by analogy, any management practices that influence the animals' well being, also influence kid production.

Specific studies are being conducted on possible methods of improving the fertility of Angora goats. The results will be reported later.

Contents

Acknowledgments

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COVER: Well-developed young kids. The proper development of young kids, both male and female, from weaning to the time they enter the breeding flock is important in obtaining good kid production.

Factors Affecting
Kid Production of Angora Does

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RAISING ANGORA GOATS AND MOHAIR PRODUCTION, an important agricultural enterprise in Texas, produced an income of more than 25 million dollars in 1959. The sale of kids or surplus breeding animals represents one of the main sources of income to Angora goat producers. However, since most Angora goats are kept for mohair production and for their value in brush control, fertility or kid production often has been neglected. As a result, the kid crop produced is low with a commonly expressed figure of 65 percent or less for the State as a whole. In addition to the direct income from the sale of surplus animals, the number of offsprings produced is important because it affects the amount of culling that can be done for valuable characteristics such as mohair production and quality. The quality of mohair rapidly decreases with the advancing age of the animal, and the weight of the mohair produced starts decreasing after approximately 5 years, Figure 1. For these reasons, it is advantageous to producers as well as to industry to have a high proportion of the flocks made up of young animals. This is possible only by having a relatively high productive rate at an early age.

A low kid crop weaned may be due to failure of the does to mate and conceive, abortion or death losses of kids after birth. All of these factors contribute to the overall problem, but they may be considered as separate entities from the standpoint of potential causes and curative measures.

Experimental Conditions

The Texas Agricultural Experiment Station has maintained an experimental flock of Angora goats since it was first established at Substation No. 7, Spur, Texas in 1915. This flock was transferred to Substation No. 14, Sonora, Texas in 1918 and more recently to the McGregor station when the latter was established in 1948. An extensive set of records was collected during this time. The present study was undertaken to attempt to isolate from these records some of the factors which influence the conception rate in Angora goats. The bulk of the data on which this report was based was collected when the experimental flock was at the Sonora station. This station is near the center of the concentrated sheep and goat producing region of the Edwards Plateau, and thus the results obtained should be comparable to conditions experienced by producers of the area.

Abortion has not been a problem in this flock and death losses of the kids have been approximately 10 percent. This low death loss figure was due to the fact that kidding occurred under close supervision which was necessary to obtain the required records. For these reasons, no particular study of abortion and death losses can be made from these records. During 28 years, 1920-48, involving more than 4,654 doe years, only 68.76 percent of the does exposed to bucks have kidded. The kid crop ranged from 96 percent in 1921 to 52 percent in 1930 at the Sonora station. The same flock or their descendants dropped a 134-percent kid crop at the McGregor station in 1958. This variation within the flock makes it possible to study the records in an effort to isolate some of the factors affecting the kidding rate.

Influence of Age

The relation of age to kid production is shown in Table 1. Females being bred for the first time as yearlings to kids at 2 years of age produce a low kid crop which generally is true of other livestock species. These data show that peak

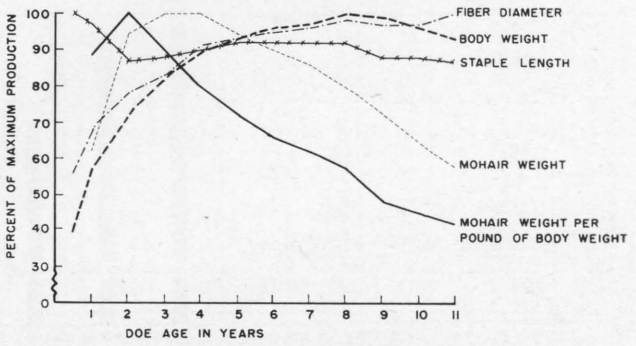

Figure 1. The relation of fleece weight, staple length, fiber diameter and body weight to age of maximum production.

TABLE 1. THE INFLUENCE OF AGE ON KID PRODUCTION OF ANGORA DOES

Age in years	Number of does bred	Average breeding weight	Percentage of kids dropped	Average weaning weight of kids
2	837	49.6	48.5	31.8
3	706	58.7	72.7	34.0
4	611	63.2	79.9	35.1
5	520	67.3	84.8	35.9
6	414	68.6	83.6	35.9
7	321	70.9	90.0	35.0
8	234	71.7	85.0	35.5
9	175	71.9	86.9	32.4
10 plus	217	70.5	77.0	31.3

production is at 7 years with generally high fertility between 5 and 9 years. This tabulation cannot be considered the absolute influence of age since some culling had been practiced with advancing age. However, the rate and method of culling was comparable to that practiced by many producers, and thus should apply to the conditions as they are experienced. The amount of culling or losses which occurred can be noted from the downward trend in the number of does bred. The breeding record by age is correlated closely with the average weight of does at breeding. These data indicate that a special effort should be made to improve or to obtain maximum performance of yearling does, and that for kid production, does may be kept as long as 9 years. Economically, kid production is secondary to mohair production and as noted earlier, the quantity and quality of hair produced deteriorates rapidly with advancing age. For this reason, it is advisable to practice culling of heavy does since they pass the years of peak mohair production at approximately 5 years. It is necessary to obtain good kid production at an early age to accomplish this. Age does not greatly influence the value of goats for slaughter purposes as contrasted with other species of meat producing animals. However, the age of the goat has an important effect on the production of the primary product, mohair, and differences in age generally are more important than genetic differences between individual animals. These facts suggest that selection practices for goats should differ markedly from other species such as sheep, and that in the doe flock only distinctly undesirable animals should be eliminated at an early age. This practice necessitates great accuracy in selecting males and the use of some type of performance records. These comments apply to the goat population as a whole and may not hold true for individual flocks in which higher prices are received from the sale of younger animals for stocker purposes.

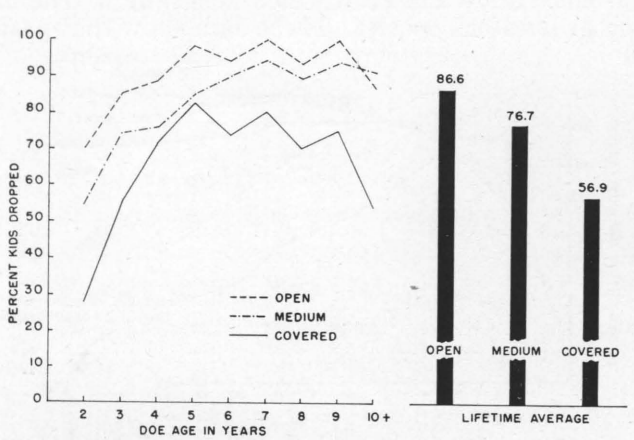

Figure 2. The relationship of face covering and fertility of Angora does, 1918-33.

Influence of Face Covering

Efforts to isolate or identify factors that contribute to early fertility led to a study of the influence of face covering.

Goat breeders generally have placed great emphasis on completeness of covering in visual selection for mohair production. This may result in using a covering of hair on the face as a direct basis of selection or because face covering may be associated with completeness of covering at other points. A heavy face covering on sheep has proven detrimental to breeding efficiency. An attempt was made in this study to investigate the effect of face covering on the breeding efficiency of Angora does. All goats in the flock were scored routinely for face covering at each spring shearing. The method of scoring for hair cover on the face was changed in 1933, and as a result, the data should be analyzed in two parts. The relation of the amount of covering to fertility from 1918-33 is shown in Figure 2, and for 1933-46 in Figure 3. These data show that the amount of hair covering on the face definitely influences fertility, and that the effect was greater for the younger does during their first years in the breeding flock. From 1918-33 there was a difference of 42.7 points in the number of kids dropped at 2 years and 29.6 points difference for their entire lifetime in the breeding flock between open and closed-face does. Similar values for 1933-46 are 62.4 and 28.5 percent. These are important figures and indicate that the selection for absence of hair covering on the face represents a major opportunity to improve breeding performance.

Breeding studies indicate that face covering is highly heritable, and that this problem can be solved through selection, Figure 4. Face covering was not found to affect mohair production in this study. Animals with extensive hair covering on the face tended to be more covered at other points. However, the direct effect of face covering on size and vigor of the animals completely counteracted the desirability for the increased covering, Table 2. The influence of face covering probably would be partially masked under conditions of heavy supplemental feeding as practiced by many stud breeders. Since heavy supplemental feeding seldom is practical in commercal range flocks, the breeding program should be directed to these conditions.

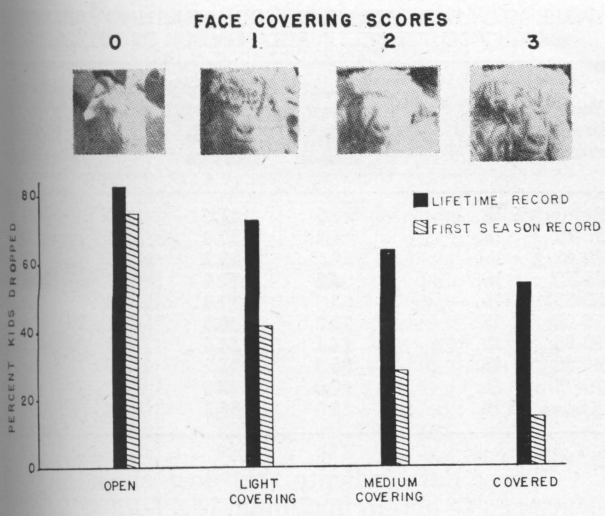

Figure 3. Face covering scores as related to the fertility of Angora does, 1933-46.

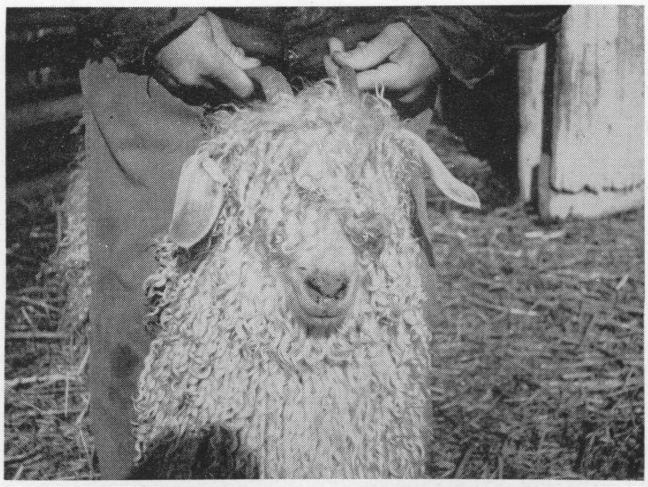

Figure 4. Hair-blinded animals, regardless of species of breeding, do a poor job of converting forage resources into saleable products.

Importance of Size and Development

The majority of producers are aware that body size or development has an effect on kid production. Also, it has been established that animals generally do not reproduce with maximum efficiency until a state of physiological maturity normal for that species has been reached. This principle was established with other species, but no data has been reported to verify the fact that this applies to Angora goats or to determine what represents optimum size and development. Likewise, no data has been reported to indicate how serious the problem of underdevelopment may be in Angora goats, and to what extent changes in the management program are warranted because of this.

The present study was undertaken to attempt to answer the above questions. When the experimental flock was at the Sonora station, all does were weighed after the fall shearing and immediately before they were placed in breeding flocks. Breeding does seldom carry much fat under range conditions, and as a result, body weight may be considered a good indication of size or development. Since a high degree of reproductive efficiency occurs only after the animal has reached a degree of development approaching normal or optimum for that species, it is possible to determine normal or optimum weights by relating breeding weight and kid production.

Preliminary correlation studies indicated that the most important weight for Angora goats was the weight of yearling does when they were first put into the breeding flock. Weight at this time was highly correlated with fertility or the number of kids produced and also the size of the kids weaned. For this reason, the does were divided into groups based on a 5-pound range in yearling breeding weights and were compared with their

TABLE 2. THE RELATION OF FACE COVERING TO BODY WEIGHT, SPRING FLEECE WEIGHT AND KID PRODUCTION OF ANGORA DOES (1933-46)

Type of face covering	Character measured	Number of animals	Doe age in years										Average	Doe years
			1	2	3	4	5	6	7	8	9	10		
Open	Body weight, lb.	57[1]	45.5	56.1	63.6	68.7	71.2	75.0	74.1	72.5	73.1	75.2	67.5	356
	Fleece weight, lb.	57	2.7	3.3	3.8	3.8	3.4	3.0	3.1	3.0	2.6	2.3	3.1	360
	Kids dropped, %	55	....	78.2	83.6	78.3	89.5	97.0	89.3	85.2	100.0	78.6	86.6[2]	315
Light	Body weight, lb.	84	41.3	53.6	62.1	67.7	72.1	74.9	72.3	75.6	75.3	75.4	67.0	482
	Fleece weight, lb.	84	2.5	3.1	3.4	3.6	3.4	3.4	3.2	2.7	2.7	2.5	3.1	481
	Kids dropped, %	84	....	45.2	77.0	90.6	91.5	89.3	87.5	88.2	92.7	75.0	81.9[2]	360
Medium	Body weight, lb.	66	40.9	52.4	62.2	66.1	69.9	68.4	71.5	76.3	72.6	71.9	65.2	411
	Fleece weight, lb.	67	2.6	3.1	3.4	3.5	3.4	3.3	3.1	2.9	2.8	2.6	3.1	431
	Kids dropped, %	68	....	29.4	69.8	74.0	72.2	83.3	100.0	85.0	83.3	75.0	74.7[2]	342
Covered	Body weight, lb.	84	38.4	49.4	56.4	63.1	66.4	68.5	70.9	73.7	73.8	71.5	63.2	527
	Fleece weight, lb.	83	2.5	3.2	3.6	3.6	3.4	3.4	3.2	3.1	3.0	2.4	3.1	538
	Kids dropped, %	76	....	15.8	44.9	52.1	75.0	66.1	78.6	81.1	69.2	68.4	61.2[2]	479

[1]The number of animals represents the number of does that were in the respective subgroups at 2 years of age.
[2]This average represents a grand mean of the respective subgroup means. Weighted means for percent kids dropped reflecting the number of animals in each age group are 85.1, 76.7, 68.4 and 56.6 for the open- through closed-face groups, respectively, and show slightly greater differences in fertility among the groups.

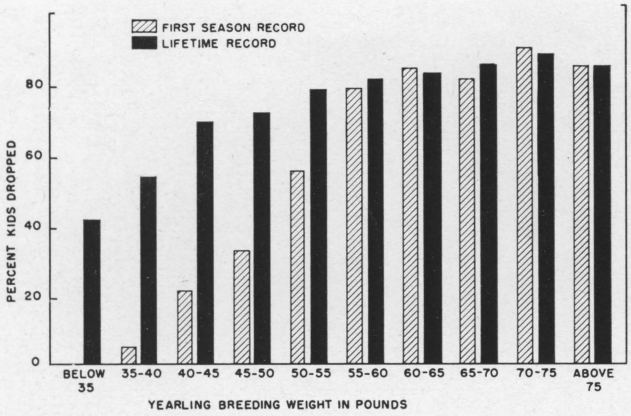

Figure 5. The relationship of yearling breeding weight to breeding performance.

subsequent breeding records. These data are shown in Table 3 and Figure 5 and indicate that adequate development of young does before they reach breeding age may be the key factor in obtaining good kid production. These data indicate that underdevelopment generally may be more serious with Angora goats than with other species of farm livestock, and that goats do not reproduce satisfactorily until they have reached a normal degree of physiological development, Figure 6. These data also indicate that shorn body weight for yearling Angora does should be a minimum of 55 pounds when they are placed in the breeding flock. There is no indication that Angora does become fat enough under range conditions for the excess weight to adversely affect breeding performance.

The relation of breeding weight to breeding performance, irrespective of age, is shown in Table 4. This table was prepared to show the optimum mature body weight for Angora does, and it indicates that at maturity Angora does should weight more than 75 pounds (shorn body weight) at the beginning of the breeding season.

Figure 6. Vigorous well-developed does are necessary for a good kid crop. The flock, of which these does are a representative sample, dropped a 134-percent kid crop in the spring of 1958.

TABLE 3. THE RELATION OF YEARLING BREEDING WEIGHT TO FERTILITY AND MOHAIR PRODUCTION

Yearling breeding weight	Percent kids dropped		Mohair production	
	First season	Lifetime average	Yearling fleece weight	Lifetime average
Below 35 lb.	0.0	41.0	3.0	3.1
35-40 lb.	4.8	53.6	3.4	3.3
40-45 lb.	20.6	69.2	3.5	3.2
45-50 lb.	32.3	71.6	3.7	3.3
50-55 lb.	55.3	77.9	3.8	3.3
55-60 lb.	78.3	80.5	4.1	3.3
60-65 lb.	84.1	81.4	4.1	3.3
65-70 lb.	80.8	85.2	4.9	3.4
70-75 lb.	90.0	87.8	4.7	3.5
Above 75 lb.	85.0	85.2	4.4	3.4

These data indicate that does should be well developed to obtain maximum breeding efficiency, and also the extent to which this may be a problem under normal management conditions, Figure 7. Approximately two-thirds, 67.3 percent, of the does weighed below the suggested minimum body weight of 55 pounds when they entered the breeding flock. Approximately three-fourths, 75.7 percent, of the adult does weighed below the suggested 75 pounds minimum desirable weight.

The differences in the performance of various sized does seem important enough to justify alteration of the management program where necessary. Management practices associated with the size and rate of development include stocking rate, supplemental feeding, parasite control and selection. It is important to adjust the size of the flock to the feed resources if the producer intends to maintain a flock of Angora goats on a continuing basis. If this is done, supplemental feeding will be required only at seasons of the year when forage quality is low, or during times of drouth emergency conditions. Supplemental feeding of doe kids or yearling does often will yield good results. Flushing has not been investigated with Angora goats, but when the flock or the group as a whole is below the weights suggested here, a period of feeding before the breeding season would be valuable in improving kid production. Adequate parasite control measures are important under many conditions and represent one way to improve the performance of Angora goats. Breeders also should favor the larger, better developed animals in selecting or culling. Size is relatively highly heritable and thus some continuing genetic improvement would be obtained by favoring large animals in selection. Also, an immediate improvement could be obtained by culling the does that are not adequately developed to give a good account of themselves in the breeding flock.

Inheritance

The influence of inheritance on fertility and reproductive performance has been studied with many classes of livestock aand the results are

TABLE 4. THE RELATION OF SHORN BODY WEIGHT TO BREEDING PERFORMANCE THE FOLLOWING SEASON (ALL AGES COMBINED)

Weight range, pounds	Number does	Percent kids		Weaning weight, pounds	Pounds kid weaned per doe bred
		Dropped	Raised		
Below 35	27	3.7	3.7		1.3
35-40	47	10.6	10.6	24.0	2.6
40-45	91	22.0	19.8	28.7	5.7
45-50	164	28.7	23.2	28.7	6.6
50-55	277	59.2	56.7	31.0	17.6
55-60	342	75.4	67.3	32.7	22.0
60-65	404	83.2	77.0	33.2	25.6
65-70	381	84.5	80.6	34.0	27.4
70-75	373	89.5	82.3	36.7	30.2
75-80	213	95.3	90.1	37.8	34.1
80-85	168	89.3	80.4	38.9	31.3
85-90	58	87.9	82.8	40.0	33.1
90-95	29	93.1	88.9	42.3	35.0
Above 95	24	100.0	87.5	38.5	33.7

variable. Inheritance has not proven to be a major cause of differences in fertility, working within a given breed of livestock, especially under range conditions. This is a logical conclusion since an inherent form of infertility automatically would be eliminated from the flock. However, when contrasting one breed with another, large fertility differences do exist, many of which are due to heredity. Hereditary differences in fertility are more important under those environmental conditions which tend to favor multiple births.

The inheritance of breeding performance of Angora goats was investigated in many respects in this study. In one comparison, twin does were compared with a group of single birth does of similar age and breeding. The reproductive performance of the twins was substantially below that of the does born as singles. Most of this was due to size since the twin does were smaller at weaning and yearling ages than those born as singles. Under range conditions the amount of twinning in Angora goats is related closely to the general fertility of the flock and thus to the environmental conditions under which they are kept.

The influence of the sire and dam on the breeding performance of their offspring also was investigated. The sire had no measureable influence on the reproductive performance of his offspring. This indicates that no major genetic differences exist or that if they do exist, they were not passed to offspring in a manner which could be measured by ordinary analysis of variance procedures. There was a slight correlation between the number of kids produced by a doe and the number produced by her female offspring (heritability of 7.5 percent). There was a significant correlation between the breeding performance of a doe expressed as a ratio of kids produced per times bred and that of her offspring. Since the sire appeared to have no influence on the breeding performance of his offspring, the dam influence apparently is due partly to the environmental influence that results in larger size (correlated environment). In other words, the larger

Figure 7. Aged does in the flock at the McGregor station. Records show that the small doe (right) weighs approximately 55 pounds (shorn body weight) and has not raised a kid. The larger doe (left) weighs approximately 80 pounds and has raised 8 kids in 6 years.

does tended to have better breeding records, and there was a highly significant correlation between the size of the dam and the size of her offspring (heritability of 58 percent). The interrelation of size, face covering and breeding performance appears to account for much of the apparent heritability of breeding performance as measured through the dam influence. As stated earlier, selection for higher fertility is automatic in nature, and to augment this by systematic culling procedures requires extensive record keeping. Selection directly for size seems to be a more practical procedure. A procedure for identification of dry does would be highly desirable so that dry does are not favored in selecting for size.

Fertility of the Male

Specific studies on the fertility of Angora males have not been conducted in the experimental flocks concerned. However, as is required in breeding registered Angoras, breeding in single sire flocks has been practiced, and as a result, any problems of infertility of males would become known. Long experience with the flock at the Sonora station indicates that with well-developed, vigorous billies of yearling age or older, sterility of males normally would not be a problem under range conditions, Figure 8. The infrequency in which low fertility is found in males indicates that with multisire flocks under normal ranch conditions for that area, male infertility or lowered fertility probably will not be a problem.

In the present experimental flock of Angora goats at the McGregor station, observations indicate that under the environmental conditions of this area, sterility or lowered fertility of males may be more of a problem. Routine semen evaluations on males have been made by the use of an electro-ejaculator in recent years. A large number of these males have proven to be of ques-

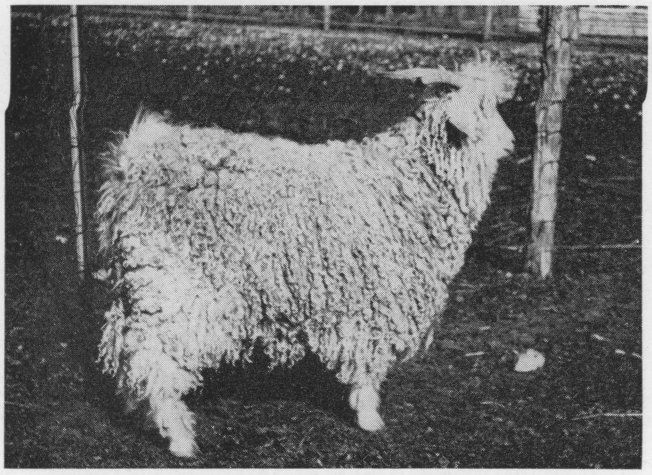

Figure 8. When well-developed vigorous males are used in a multisire breeding program, the fertility of males seldom is a limiting factor. When single sire flocks are used, extreme care should be taken to insure that a sterile or low fertility male does not cause the loss of a kid crop.

tionable fertility by this procedure. Some of these males have been used for breeding, and most did a satisfactory job of settling the does to which they were mated. Approximately 1 male in 10 has been infertile for all or a part of the breeding season. One male in 10 with lowered fertility would not be a problem in multisire flocks unless this male was the dominant one of the group. In single sire flocks, required in breeding registered goats, an element of chance is involved when does are exposed to only one male without any knowedge of his fertility. Fertility testing of potential breeding males is possible, but at present it is not practical for widespread use. In common usage, the practice of exposing the does to a second male after approximately 5 or 6 weeks in the breeding flock seems to be a practical method of reducing the likelihood of losing a complete kid crop on a group of does. This could be done by rotating males with at least 5-day intervals between exposure or by replacement with a male which had been held in reserve.

Recent work with the flock at the McGregor station has shown that breeding activity is concentrated about the 10th day after the billies are placed with the does, and the males may be overworked at this time. The kid crop might be improved by concentrating the males with a portion of the flock for approximately 2 weeks. Then they could be pulled out and placed with a second group leaving a few billies to breed the does that were missed or which failed to come into heat at the start of the season. A later report will deal with this subject in more detail.

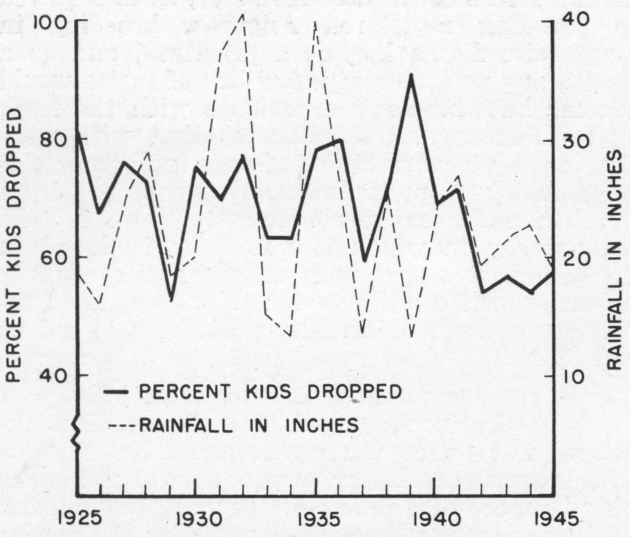

Figure 9. The relationship of 12-month precipitation and the percentage of kids dropped for the 20-year period, 1925-45 at the Sonora station.

Environmental Influences

Environment, or some element thereof, which influences the well being of the animals greatly influences fertility. This is illustrated by the fact that in the same flock the number of kids dropped has varied from 52 to 134 percent, with a variation of more than 20 percent in subsequent years. This has occurred without voluntary selection for or against fertility, and in the latter case, no substantial genetic change would be possible from year to year.

Some of the factors enumerated earlier, such as age and size, represent environmental influences in a broad sense. Figure 9 shows that considerable variation in fertility from year to year exists. Many factors arising with climate or management practices have contributed to this variation.

Some correlation studies were conducted using data for the number of does in the flock, kid production and rainfall by season for the 1921-47 period. There was a significant negative correlation (−.42) between the total number of does in the flock and the percentage of does kidding. This probably is the result of stocking rate and indicates the need to balance livestock numbers with available feed resources.

There was a significant positive correlation between the percentage of does kidding (.39) or kids dropped (.38) and the total yearly rainfall for the year in which the does were bred. The relationship between these two variables is shown in Figure 9. There is a distinct tendency for these variables to be related, except for the year 1939. A closer study by seasons indicates that the existing correlation is due almost entirely to the influence of spring and summer rains (April through September). Correlation studies do not indicate that the amount of rainfall in the late fall and winter has any significant influence on fertility of the doe flock.

The variation in rainfall and stocking rate still accounts for less than half of the year-to-year variation in fertility of the doe flock. This suggests that management practices may be at least partially effective in alleviating these environmental influences.